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Principles of Interconnection:

A Response to "Regulation of Access to Vertically-Integrated Natural Monopolies,"

submitted to the New Zealand Ministry of Commerce

Executive Summary

Following privatization of Telecom NZ and entry of competing network operators, significant disputes have arisen over termination pricing and other terms of interconnection. This paper describes *principles of interconnection* and it proposes that they be incorporated in the law, so that they are applied to negotiations and possible arbitration of disputes among network operators. The main objective of these principles is the leveling of the competition playing field, so that the benefits of competition (lower prices, higher quality of service, and innovation) can be realized. The principles are: mandatory interconnection of networks; reciprocity of interconnection charges for the same service; no discrimination across network operators for the same service; unbundling of interconnection charges; geographic de-averaging of interconnection charges; and exclusion of monopoly rents from interconnection charges. We show how these principles help in promoting competition and increasing efficiency. We also discuss in detail the inappropriateness of the use of the "efficient component pricing rule" in the telecommunications sector in New Zealand.

Principles of Interconnection:

**A Response to "Regulation of Access to Vertically-Integrated Natural Monopolies,"
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1. Introduction

In the wake of the privatization of Telecom NZ and entry of competing network operators, the telecommunications sector of New Zealand has been in upheaval. Telecommunications services providers have been fighting over conditions of competition, and in particular about interconnection terms and prices.¹ The Ministry of Commerce of New Zealand took the courageous step of asking for general advice on these issues. This essay constitutes my response to the open invitation for comments on the Discussion Paper of the Ministry of Commerce.

The issue of interconnection terms and prices is at the heart of the definition of competition among network operators in a network of (interconnected) networks. Unless this issue is adequately resolved, networks may not be able to interconnect. In that case, the well-accepted fact of life that a caller can reach anyone around the world through a ubiquitous network of interconnected telephone networks may cease to be true.

The access pricing problem which arises today in the New Zealand telecommunications sector is a result of the lack of appropriately defined and understood access pricing principles that can guide network operators to negotiate and agree on interconnection charges *without recourse to lengthy and costly dispute resolution procedures*. For example, there is today no

¹ One of the most protracted disputes, between Telecom NZ and Clear Inc., reached the Privy Council of the House of Lords which serves as the Supreme Court of New Zealand. The Privy Council ruled that the "Efficient Component Pricing Rule" is lawful (i.e., it does not violate Sec. 36 of the Commerce Act), but declined to rule on issues of monopolization of the market, considering instead these issues as falling in the domain of legislation. Thus, the fundamental issue of monopolization remains unresolved

agreed basis to require, or to provide incentives to the dominant incumbent to charge non-discriminatory, fair and reasonable interconnection prices. Telecom NZ, a dominant firm, does not have incentives to choose fair and reasonable access prices and other interconnection terms, while it has every opportunity to charge access prices which minimize competitive threats.

This submission attempts to briefly analyze the interconnection problem in the context of New Zealand and to propose interconnection principles that, if added to the Telecommunications Act or the Commerce Act, will define an environment in which network operators will be able to negotiate with each other and define fair and reasonable interconnection terms. The proposed principles are within the framework of light-handed regulation and do not require the establishment of a regulatory body.² Further, the adoption of these principles will promote competition, increase efficiency, promote innovation, and decrease prices for telecommunications services in New Zealand.

2. Two-way networks³

It is useful to start with a brief look at the structure of competition in interconnected networks. At a first glance, it looks straightforward that a network operator, irrespective of the degree of its monopoly power in some part of the network, should be willing to interconnect with operators "upstream" or "downstream". As long as two networks provide *complementary* components, the combination of which creates end-to-end services, each network finds it profitable to interconnect with the other. Thus, when two networks are just *vertically* related,

² Of course, there are a number of other solutions outside the framework of light-handed regulation. These range from interconnection terms and charges set by a regulator to a break-up of the dominant firm.

³ The term *two-way networks* was coined by Economides and White (1994) to denote networks where services going in opposite directions are distinct (as in telephony).

interconnection is mutually profitable, and the exclusion of rivals is not consistent with profit maximizing behavior.⁴

Often, however, networks offer *substitute* services; i.e., are *horizontally* related. For example, two networks may both offer local service, or one network may offer fixed local service while the other offers mobile service. In this case, each network has every reason to compete very hard and to try to prevent the other from bringing its product or service to the consumers. If a network finds it possible, it will try to squeeze the other out of business or at least marginalize it.

Typically, *the structure of a network of interconnected networks (often called a "network of networks") is complex, and it encompasses both horizontal and vertical elements.* For example, two networks that offer local service are in horizontal competition for subscribers. At the same time, the two networks are vertically related for calls that go across networks, since such calls are comprised of an origination component in one network and a termination component in another network. In this case, a network operator has the incentive to foreclose or marginalize an opponent network, and it is able to do so through high interconnection fees. This results in high prices for end-to-end services, to the detriment of consumers. These (and other) problems arising from market dominance in a network of networks may be solved by the guidance of competition through a set of principles. It is necessary first to define the goals of public policy.

⁴ See Economides and Woroch (1992). This does not imply that, in strictly vertically related networks, there will be no interconnection disputes. Typically the provision of end-to-end services generates profits which will have to be divided between the two network operators. However, this *vertical* dispute should be distinguished from *horizontal* disputes that arise when two networks provide substitute services. When networks provide substitute services, each has an incentive to eliminate or marginalize the other; this is not the case when the networks are in purely vertical relations.

3. Goals of Public Policy

The goal of policy for the telecommunications sector is to pursue allocative, productive and dynamic efficiency. To pursue efficiency, policy makers must create a legal and business environment where firms can freely compete on an equal footing. Economic theory predicts that competition on a level playing field will lead to efficient production, efficient pricing and the highest benefits for consumers and producers.

The present competitive playing field in the telecommunications sector in New Zealand is far from level. The existence of a dominant incumbent, the “adoption” of the ECPR and the weakness of competition law each enable the dominant incumbent former state monopolist to dictate terms that limit competition and marginalize or exclude actual and potential entrants.

It is vital from a policy perspective to reduce the tilt of the playing field that today overwhelmingly benefits the dominant incumbent. In the absence of a structural solution (such as the divestiture of AT&T), and given a regime of light-handed regulation and ineffective competition law, the *only* available instruments are guidelines or restrictions affecting the conduct of network operators.

Below we suggest a set of access pricing principles which will make that playing field more level. Even so, the dominant structural position of the incumbent (and the resulting tilting of the playing field) presents very considerable challenges to policy makers in the context of a light-handed regulatory regime. If these access pricing principles are adopted we expect that:

- competition will be strengthened
- prices will fall
- new services will be deployed at an accelerated rate
- quality will be enhanced
- more efficient network usage will be achieved
- greater overall efficiency will be achieved

4. **Principles of Interconnection**

We propose the following principles to govern interconnection terms and prices.

Principle 1: *mandatory interconnection of networks*

Principle 2: *reciprocity of interconnection charges*

Principle 3: *no discrimination across network operators for the same service*

Principle 4: *unbundling of interconnection charges*

Principle 5: *geographic de-averaging of interconnection charges*

Principle 6: *exclusion of monopoly rents from interconnection charges*

The objectives of these principles are: first, to encourage interconnection of networks in order to create services which have the effect of driving prices down and which meet users' service needs; second, to create a level playing field where network operators can freely compete on an equal footing, leading to an efficient telecommunications sector; third, to ensure that prices stimulate efficient usage of networks; and fourth, to provide correct signals for network operators to innovate.

The crux of the intuition of these principles lies in the recognition that today the telecommunications sector in New Zealand is essentially a "network of networks," rather than customers connecting to a natural monopoly provider. The structure of a network of networks is complex as it encompasses both horizontal and vertical elements. Traditional public policy remedies that work well in purely horizontal or vertical situations prove inadequate. The policy solution lies in finding the appropriate principles to achieve efficient interconnection of *multiple two-way networks*.

Economic analysis⁵ shows that, in an unregulated market, interconnection charges are expected to vary widely depending on the sizes of competing local networks and the ability of a dominant incumbent to precommit on the level of the interconnection charges so as to

⁵ Economides and Woroch (1992, 1995)

implement a price squeeze on an entrant or rival. Equality of termination charges for calls that go in opposite directions in two-way networks occurs in these models of an unregulated network of networks only when the network operators are strategically symmetric and can act simultaneously. In this case, the ability of either network operator to implement a price squeeze on the opponent is largely restricted. In an unregulated network of networks, strategic inequality results in higher prices for end-to-end final services and reduced consumers' satisfaction. The lowest prices for end-to-end services occur when the competing local networks have the same strategic power.

In the absence of adequate regulation, a dominant local network operator that has the ability to set interconnection charges earlier than smaller network(s) can:

- set high termination charges to “price squeeze” smaller networks;
- reduce the amount of satisfaction that a consumer may get from subscribing to a smaller network;
- lock-in current customers by making it costly for them to switch to competing networks.

Thus, a dominant local network operator can use interconnection charges as a tool of horizontal competition against a direct competitor that offers a similar service.

Analysis of theoretical models shows⁶ that the ability of a dominant incumbent to use its strategic power through precommitment on the level of interconnection charges is severely restricted by the principles defined earlier:

- *Mandatory interconnection* ensures that small networks are not summarily excluded.
- *Reciprocity of interconnection charges* ensures that strategic power is roughly equally divided between two network operators of different sizes and quite different abilities to precommit. Even when the dominant network operator is able to precommit on interconnection charges, the reciprocity principle removes the strategic power from the

⁶ Economides and Woroch (1995).

dominant incumbent. If the reciprocity principle is not applied, the dominant incumbent has an incentive to choose a high interconnection charge and have the entrant respond with a low interconnection charge. But this is ruled out under reciprocity.

- *No discrimination across network operators* for the same service ensures unbundling of termination service. Since some of the relationships of other fellow networks to the dominant incumbent are essentially vertical while others are essentially horizontal, the dominant incumbent has an incentive to use different interconnection charges when dealing with different network operators. The dominant incumbent has an incentive to charge a higher interconnection charge to horizontally related network operators (as well as to vertically related networks). The principle of non-discrimination across network operators for the same service ensures that this horizontal price squeeze is costly to the dominant incumbent. It therefore does not have an incentive to use this strategy.
- *Geographic de-averaging* of interconnection charges ensures more efficient pricing across the many different geographic markets that exist in the telecommunications sector.

4.1 Mandatory Interconnection of Networks

By *mandatory interconnection of networks*, we mean that a network operator is required to offer fair and reasonable terms and conditions, including access prices, to competing and complementary network operators. This principle counteracts the tendency for a dominant incumbent to use its control of essential network facilities to restrict competition in markets for substitute services.

A minimal restriction on network operators is that interconnection charges fall between average incremental cost and average forward-looking stand-alone cost. Care needs to be taken in computing stand-alone costs. It is necessary to ask what the costs are of providing access on

a stand-alone basis given by best practice (i.e., the most advanced state of knowledge of, and expertise used by, any network operator).⁷

4.2 Reciprocity of Interconnection Charges

The principle of *reciprocity of interconnection charges* means that the interconnection pricing schedule offered by network A to network B for calls that originate from network B and pass through or terminate in network A is the same as the interconnection pricing schedule offered by network B to network A for calls that originate in network A and pass through or terminate in network B. Reciprocity is to be applied for termination services of the same geographic and other features. If termination in one network is of higher quality, say in mobile vs. fixed service, this can be reflected in higher prices.⁸

Reciprocity is designed to counteract the ability of a dominant incumbent to use its greater strategic power to extract superior interconnection terms and conditions from a weaker rival or a new entrant. The disparity in the relative sizes of the network operators is a principal source of this imbalance. Another source of this imbalance is the ability of the dominant incumbent to pre-commit to terms and conditions on the basis of its entrenched position.

In the absence of reciprocity, the dominant incumbent can disadvantage its rivals by charging exorbitant rates for incoming traffic. At the same time, it can extract very low rates to terminate traffic on its rival's network. The result of the dominant network's actions is high prices for end-to-end services. Given such prices, consumers overwhelmingly decide to subscribe to (or stay with) the incumbent. Thus, in the absence of reciprocity, a dominant

⁷ This requires the separation of those expenditures necessary to provide interconnection services. In addition, it is necessary to require that network operators use in their computations "best practice" forward-looking technology, regardless of the actual technology used in their network. Otherwise, the calculations do not reflect present social opportunity costs.

⁸ Reciprocity is not always equivalent to a system of "bill and keep". Of course, they are equivalent when the volumes of calls are equal across networks.

incumbent can use interconnection charges to gain a *horizontal* advantage against a competing network, resulting in a restriction of competition as well as high prices for end-to-end services. On the other hand, when termination prices must be the same in both directions, the dominant incumbent will itself choose lower termination prices. Thus, the result of reciprocity is lower prices for end-to-end services and, therefore, higher consumer welfare.

4.3 No Discrimination Across Fellow Network Operators

The principle of *no discrimination across fellow network operators for the same service* means that a network operator must charge the same interconnection charge for the same service to any other network operator as it charges to itself. Thus, for example, network operator A providing call termination services to network operators X and Y, as well as to itself, must charge the same amounts to itself as well as to each of the other network operators. This principle has been called imputation when applied in bilateral relations only; i.e., to define charges between network operators A and X. This principle sets the same termination charge for all calls irrespective of their origination (international, long distance, or local). Thus, it follows the general trend towards unbundling of telecommunications services.⁹ However, this principle gives the freedom to network operators to use any non-linear pricing schedule (such as quantity discounts).

The non-discrimination requirement is designed to prevent a dominant incumbent from tailoring its interconnection charges to "manage" the competition among service providers. It is likely that, in the absence of non-discriminatory interconnection, the network operators that provide the closest substitutes to the dominant incumbent's services will face the highest interconnection charges. In the absence of the non-discrimination requirement, network

⁹ By implication, this principle precludes a network operator from charging less for its final services than for the sum of the various components used in its final service, and sold to rivals.

operators have severely diminished incentives to innovate because most of the gains will be “taxed” away through interconnection charges.

4.4 Unbundling of Interconnection Charges

The principle of *unbundling of pricing of interconnection services* requires network operators to define those services needed by other network operators to terminate traffic and offer them on a stand-alone basis. It does not insist that network operators unbundle all the intermediate or final services that they provide.

This principle is intended to deal with the ability of a dominant incumbent effectively to raise interconnection charges to exclude a rival, or at least to extract its profit through a “price squeeze”. Without unbundling, a dominant carrier can skirt the reciprocity principle by offering a highly bundled termination service at a correspondingly high price. Incapable of providing many components of the bundle, a rival would effectively be required to pay high termination charges. Unable to reciprocate with a like service, the rival would charge a much lower price for a more basic termination service. Thus, unbundling of interconnection pricing is necessary for a leveling of the competitive playing field.

4.5 Geographic De-averaging of Interconnection Charges

The principle of *geographic de-averaging of interconnection charges* states that interconnection charges should take account of different geographic markets and different customer markets. At its most basic, for example, this principle means that interconnection charges should differ in different parts of the country. This principle counteracts the tendency of the dominant incumbent to shift its costs between different geographic and customer markets so as to hide the location of its most profitable markets and avoid competition.

5. Inappropriateness of the ECPR

Principle 6 states that monopoly rents should be excluded from interconnection charges. This is because we envision that it is desirable to encourage entry and competition not as ends in themselves but as means to increase the efficiency of the telecommunications sector. In particular, it is desirable that entry and competition precipitate reductions of prices of telecommunication services. If monopoly rents are included in interconnection charges, entrants will be excluded or marginalized. Then, prices of end-to-end telecommunications services will remain high.

The "Efficient Component Pricing Rule" (ECPR) proposed by Baumol, Sidak, and Willig, preserves monopoly rents for the incumbent even in the event of entry. It specifies that the access charge paid by the entrant or rival to the monopolist should be equal to the monopolist's opportunity costs of providing access, *including any forgone revenues from a concomitant reduction in the monopolist's sales of the complementary component*.¹⁰ Thus, ECPR proposes that an incumbent is fully compensated for any reductions in its profit created by entry. The net result is a perpetuation of high prices of telecommunications services despite entry. Thus, ECPR is totally inappropriate as an interconnection pricing rule.¹¹

The ECPR was proposed with the intent of excluding entrants that produce less efficiently than the incumbent. It holds as a first-best pricing principle (i.e., it maximizes social welfare) in a *static world only if a very stringent set of assumptions holds*:¹²

¹⁰ See Baumol (1983), Baumol and Sidak (1994a, 1994b), Economides and White (1995).

¹¹ The Privy Council, in its decision on *Telecom v. Clear* ruled that the ECPR was lawful. A fundamental confusion exists in the Privy Council decision between actual costs, opportunity costs, and social costs. The ECPR is based on the sum of the actual and opportunity costs of the dominant incumbent monopolist. These opportunity costs are not actual costs; they are monopoly rents of the incumbent. They imply a high interconnection charge *even if there is no "common cost" of the dominant incumbent*. In general, private opportunity costs are not social opportunity costs. They do not reflect overall allocative efficiency.

¹² See Economides and White (1995); Laffont and Tirole (1994)

- the monopolist's price for the complementary service is based on a marginal cost pricing rule;
- the monopolist's and entrant or rival producer's components are perfect substitutes;
- the production technology of the component experiences constant returns to scale;
- the entrant or rival producer has no market power;
- the monopolist's marginal cost (or average incremental cost) of production of the component can be accurately observed;
- the quantity demanded of the complementary service is left unchanged by entry.

If any of these assumptions does not hold, the ECPR will lead to allocative and dynamic inefficiencies which can be very significant. In particular, when the monopolist which controls the bottleneck facility does not price at marginal cost (the first assumption is violated), the ECPR leads to a perpetuation of high prices for end-to-end services.¹³ Accordingly, consumers who would have been served in a competitive market are, under the ECPR, excluded from the market because of the high price. This results in a significant allocative inefficiency.

It is well established by economic theory, as well as by empirical observation, that a monopolist which is not restrained by regulation or competition law will use its ability to price above cost. The monopolist holder of a bottleneck facility is no exception. It will price its output above cost and so reap supernormal (monopoly) profits. While the use of monopoly power and pricing above marginal cost are each a natural and expected behavior by a monopolist, neither can be easily ascertained by observation of its accounts. It is well understood that items which appear as profits to competitive firms often instead appear as costs in the accounts of a monopolist. Accordingly, the crucial issue on the appropriateness of the ECPR is not the appearance of accounting profits but rather the determination of the ability of

¹³ Armstrong, Doyle, and Vickers (1995) modify ECPR to account for the case when the services of the incumbent and the entrant are imperfect substitutes. However, they still assume (as do Baumol *et al.*) that the price of output does not change as a result of entry. Thus, their modification does not deal with the fundamental flaw of the ECPR.

the bottleneck monopolist to price above marginal cost. In New Zealand, there is no doubt that Telecom is a dominant firm and is able to price above cost.¹⁴ Moreover, in New Zealand, legal restraints on monopoly behavior are weak. Accordingly, the telecommunications sector in New Zealand is an industry where the ECPR is an *inappropriate* access pricing principle

Entrants in the complementary good market that are equally efficient or more efficient than the incumbent will not be discouraged from entering through the application of the ECPR. Accordingly, where there are more efficient (than the monopolist) or equally efficient potential entrants, the application of the ECPR results in a pure allocative loss. Even if the potential entrant in the complementary good market is less efficient than the monopolist, application of the ECPR often leads to efficiency losses. Economides and White (1995) show that the exclusion of inefficient rivals through the use of the ECPR may be socially harmful. This is because the market presence of even one inefficient rival could bring net social benefits by causing the price to fall sufficiently so that the net gain to consumers (the reduction in the deadweight loss “triangle”) would exceed the inefficiency costs of the rival’s production.

When the technology of production involves increasing returns to scale, which is the typical case in telecommunications, a monopolist may use the ECPR rule to exclude or marginalize a more efficient rival. The monopolist uses the ECPR to establish high interconnection charges that result in a restriction of the scale of operation of the rival in the complementary market. Because of the existence of increasing returns to scale, the rival operates at the high end of its cost curve. The dominant incumbent is able to raise the production costs of its rival through the implementation of the ECPR. Accordingly, the rival is hurt by the ECPR twice: first, because of high interconnection charges; and second, because it is forced to operate at small scale and at high unit cost. Thus, the ECPR can be used to implement a tight profit squeeze on a rival or even to exclude the rival. In this process,

¹⁴ This is expressly made clear by the Privy Council in *Telecom v Clear*.

consumers are deprived of lower prices that would have resulted from competition if ECPR was not applied.

In the presence of ECPR, the monopolist has an incentive to understate its marginal costs of production of the complementary component (i.e., the service where it faces competition) and then employ the ECPR to levy an exclusionary access charge vis-a-vis its rival. The effects of this strategy are similar to the ones described in the previous paragraph. That is, more efficient rivals are excluded. Even if the monopolist is constrained to earn zero profits in the bottleneck market, if its costs are not perfectly observed, it can claim that some marginal costs of the complementary services are marginal costs of the bottleneck service.¹⁵ Lower marginal costs of the complementary component justify a higher charge under the ECPR. This higher charge will now deter even those rivals which are more efficient than the monopolist in the production of the complementary component.

The ECPR reduces competition in markets that are both vertically related and horizontally related to the bottleneck monopolist. By requiring any interconnecting network to pay high access charges, the ECPR ensures a reduced impact of competition in any market that is vertically related to the bottleneck monopoly (i.e., any market that provides goods or components that are complementary to the service for the bottleneck monopolist). Accordingly, since long distance providers have to interconnect with the bottleneck monopolist in the local market, the application of the ECPR by the bottleneck monopolist reduces the impact of competition in the long distance market.

A local competitor of the bottleneck monopolist is harmed by the application of the ECPR. A competitor of the dominant incumbent monopolist which provides local service in some regions or which provides mobile service (a substitute to fixed local service) requires interconnection to the local network of the monopolist. Since the component of final service

¹⁵ This "cost shifting" argument was used to justify the breakup of AT&T into unregulated and regulated parts.

provided by the competitor is complementary to the component of the final service provided by the owner of the bottleneck facility, the two firms, monopolist and competitor, are vertically related. At the same time, the competitor may be seeking actively to win subscribers over to its network. It is thus in direct competition with the dominant incumbent monopolist. The ECPR justifies to the monopolist high interconnection charges that lead to a marginalization of the competitor (through a price squeeze). The ECPR therefore reduces horizontal competition.

Therefore, *the ECPR effectively prohibits competition in the bottleneck market*. Often, a bottleneck market is described as a natural monopoly. The ECPR makes the bottleneck market a *legal monopoly*, irrespective of whether or not it is a natural monopoly. When the ECPR is applied, the possibility of competition in the bottleneck market is eliminated. This is because a potential entrant in this market must pay to the dominant incumbent its full opportunity cost. Accordingly, the application of the ECPR rule can lead to horizontal exclusion.

The transformation of a natural monopoly into a legal monopoly is especially important because the natural monopoly feature of a market may be only temporal. In telecommunications, technological change has often transformed markets from natural monopolies to oligopolies and even competitive markets. For example, the long distance market is no longer a natural monopoly. Presently, technological change in wireless and cable TV communications is transforming the local telephone access market to an oligopoly. When the ECPR is applied, the monopoly is perpetuated, some potential entrants do not enter, and others enter and are marginalized. The lack of competition that would have occurred in the absence of ECPR implies, in the presence of ECPR, a very significant loss of dynamic and allocative efficiency.

By its nature, the ECPR perpetuates the monopoly profits that a dominant incumbent enjoys. Accordingly, the ECPR transforms the temporal gain of a dominant incumbent into a permanent and recurring gain. *In this way, the ECPR does exactly the opposite of what competition is supposed to accomplish: the ECPR keeps prices and profits high. Instead of squeezing out monopoly profits, the ECPR prevents competition from squeezing them out.*

It should also be noted that the ECPR was not designed to collect contributions to defray a revenue shortfall. This was not its purpose. There is a well known solution to the problem of raising money in an optimal way for a revenue shortfall. The solution follows the Ramsey rule of inversely relating revenue contributions to the elasticities of demand. This rule is not related to the ECPR.¹⁶

Finally, it is important to note that the ECPR is insensitive to local market conditions. The ECPR as adopted by the Privy Council assumes a high level of geographic and customer class averaging. In general, average incremental cost as well as opportunity cost will vary across regions in groups of customers. Opportunity costs vary with the demand for various telecommunications services by different groups of consumers who have different demand characteristics (such as elasticities). Opportunity costs also vary according to demand at different times of day. Any serious attempt to implement the ECPR must give different component charges for each stratified class of consumers in each region and at different times of the day.

If the ECPR is applied as a single charge across regions and classes of customers, it will result in acute distributional effects across consumer classes and regions. Rural consumers, regardless of their ability to pay, will be subsidized by poor urban consumers. Therefore, a single ECPR charge across classes of consumers and regions creates further significant allocative distortions. These distortions result in the wrong signals being sent to potential entrants. Entrants will not enter in the appropriate markets and will instead enter in the “wrong” markets.

In summary, the ECPR rule affects competition adversely in both horizontally related and vertically related markets (with respect to the bottleneck monopoly). The ECPR perpetuates the monopoly of a dominant incumbent, such as Telecom NZ resulting in:

¹⁶ As a result, the use of the ECPR to collect any contribution to Telecom’s joint and common costs (together with contributions to cover the so-called Kiwi Share “obligation”) will further drive prices away from efficient levels. The actual size of the efficiency losses that will occur as a result of the ECPR still need to be quantified

- significant reduction of competition;
- loss of allocative and dynamic efficiency;
- high prices;
- reduction of production.

In conclusion, the application of the ECPR in the telecommunications market in New Zealand is not an appropriate access pricing principle. Application of the ECPR in New Zealand will lead to significant losses in efficiency.

6. Conclusion

A brief examination of the strategic structure of competing interconnected telecommunications networks in New Zealand reveals that, in the absence of any intervention, it is in the interests of the dominant incumbent (Telecom NZ) to exclude, price squeeze, and marginalize competing network operators. We explained how the network structure gives the opportunity to the dominant firm to create a horizontal exclusion through high interconnection prices. Such actions also result in high prices for consumers and reduce the efficiency of the telecommunications sector.

To avert these adverse consequences, and in the context of light-handed regulation, we proposed six principles to govern interconnection of telecommunications networks. They are to be incorporated in the law so that they guide negotiations and possible arbitration among network operators. These principles are designed to work as a whole to promote competition, increase economic efficiency, promote innovation, and decrease prices for telecommunications services in New Zealand.

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Research Interests

Industrial Organization, Network Industries, Structure of Financial Markets, Law and Economics.

Teaching Experience

Graduate Industrial Organization, Topics in Industrial Organization, Strategic Interaction in Markets and Industries, Undergraduate Industrial Organization, Seminar in Industrial Organization, Microeconomics, MBA Microeconomics, Seminar in Microeconomics.

A. PUBLISHED AND FORTHCOMING PAPERS IN REFEREED JOURNALS

1. "Electronic Call Market Trading," *Journal of Portfolio Management*, vol. 21, no. 3 (Spring 1995), pp. 10-18 (with Robert A. Schwartz).
2. "The Economics of Networks," forthcoming *International Journal of Industrial Organization* (1996), vol. 14, no. 2.
3. "The Political Economy of Branching Restrictions and Deposit Insurance: A Model of Monopolistic Competition of Small and Large Banks," forthcoming, *Journal of Law and Economics* (October 1996) (with R. Glenn Hubbard and Darius Palia).
4. "Equity Trading Practices and Market Structure: Assessing Asset Managers' Demand for Immediacy," *Financial Markets, Institutions & Instruments*, vol. 4, no. 4 (November 1995), pp. 1-46 (with Robert A. Schwartz)

5. "Access and Interconnection Pricing: How Efficient is the 'Efficient Component Pricing Rule'?", *The Antitrust Bulletin*, vol. XL, no. 3, (Fall 1995), pp. 557-579 (with Lawrence J. White).
6. "The Inefficiency of the ECPR Yet Again: a Reply to Larson," forthcoming, *The Antitrust Bulletin* (1996) (with Lawrence J. White).
7. "Network Externalities, Complementarities, and Invitations to Enter," forthcoming *European Journal of Political Economy* (1996).
8. "Commentary on 'Antitrust Economics of Credit Card Networks,' *Federal Reserve Bank of St. Louis Review*, November-December 1995, pp. 60-63.
9. "Competitive Positioning with Non-Uniform Preferences," *Marketing Science*, vol. 13, no. 3 (Summer 1994), pp. 248-273 (with Asim Ansari and Avijit Ghosh).
10. "Networks and Compatibility: Implications for Antitrust," *European Economic Review*, vol. 38 (March 1994), pp. 651-662 (with Lawrence J. White).
11. "Comments on 'Ranking Alternative Trade-Restricting Policies Under Duopoly', by Jota Inshikawa," *Japan and the World Economy*, vol. 6 (1994), pp. 171-173.
12. "Quantity Leadership and Social Inefficiency," *International Journal of Industrial Organization*, vol. 11, no. 2 (1993), pp. 219-237.
13. "Quality Variations in the Circular Model of Differentiated Products," *Regional Science and Urban Economics*, vol. 23, no. 2 (1993), pp. 235-257.
14. "Hotelling's 'Main Street' With More Than Two Competitors," *Journal of Regional Science*, vol. 33, no. 3 (1993), pp. 303-319.
15. "Network Economics with Application to Finance," *Financial Markets, Institutions & Instruments*, vol. 2, no. 5 (December 1993), pp. 89-97.
16. "Competition and Integration Among Complements, and Network Market Structure," *Journal of Industrial Economics*, vol. XL, no. 1 (1992), pp. 105-123 (with Steven C. Salop).
17. "Desirability of Compatibility in the Absence of Network Externalities," *American Economic Review*, vol. 79, no. 5 (December 1989), pp. 1165-1181.
18. "Symmetric Equilibrium Existence and Optimality in Differentiated Products Markets," *Journal of Economic Theory*, vol. 47, no. 1 (1989), pp. 178-194.
19. "Quality Variations and Maximal Product Differentiation," *Regional Science and Urban Economics*, vol. 19 (1989), pp. 21-29.

20. "The Division of Markets is Limited by the Extent of Liquidity," *American Economic Review*, vol. 78, no. 1 (March 1988), pp. 108-121 (with Aloysius Siow).
21. "The Economics of Trademarks," *Trademark Reporter*, vol. 78 (July-August 1988), pp. 523-539.
22. "On Nash Equilibrium Existence and Optimality in Oligopolistic Competition in Prices and Varieties," *Greek Economic Review*, vol. 9, no. 2 (1987), pp. 198-209.
23. "Nash Equilibrium Existence in Duopoly with Products Defined by Two Characteristics," *Rand Journal of Economics*, vol. 17, no. 3 (1986), pp. 431-439.
24. "Stable Cartels," *International Economic Review*, vol. 22, no. 2 (1986), pp. 317-327 (with M.P. Donsimoni and H.M. Polemarchakis).
25. "Minimal and Maximal Product Differentiation in Hotelling's Duopoly," *Economics Letters*, vol. 21 (1986), pp. 67-71.
26. "The Pareto-Optimal Design of Term Life Insurance Contracts," *Scandinavian Actuarial Journal* (1985), pp. 49-63 (with David F. Babbel).
27. "Existence of Equilibrium in Price-Quality Competition," *Greek Economic Review*, vol. 7, no. 2 (1985), pp. 179-186.
28. "The Principle of Minimum Differentiation Revisited," *European Economic Review*, vol. 24 (1984), pp. 345-368.
29. "Do Increases in Preference Diversity (Across Countries) Induce Increases in Trade? An Affirmative Example," *Journal of International Economics*, vol. 17 (1984), pp. 375-381.
30. "The Demand for Life Insurance: An Application of the Economics of Uncertainty: Comments," *Journal of Finance*, vol. 37, no. 5 (1982), pp. 1305-1309.

B. PUBLISHED PAPERS IN BOOKS AND NON-REFEREED JOURNALS

1. "Critical Mass and Network Evolution in Telecommunications," in *Toward a Competitive Telecommunications Industry: Selected Papers from the 1994 Telecommunications Policy Research Conference*, Gerard Brock (ed.), 1995 (with Charles Himmelberg).
2. "How to Enhance Market Liquidity," chapter 6 in R. Schwartz (ed.) *Global Equity Markets*, Irwin Professional. New York: 1995.
3. *Making the Trade: Equity Trading Practices and Market Structure - 1994*, TraderForum, Institutional Investor.
4. "The Quality of Complex Systems and Industry Structure," in William Lehr (ed.), *Quality and Reliability of Telecommunications Infrastructure*. Lawrence Erlbaum. Hillsdale: 1995 (with William Lehr).

5. "Differentiated Public Goods: Privatization and Optimality", in *Does Economic Space Matter? Essays in Honour of Melvin L. Greenhut*, edited by H. Ohta & J.-F. Thisse. St. Martin's Press. New York: 1993 (with Susan Rose-Ackerman).
6. "A Monopolist's Incentive to Invite Competitors to Enter in Telecommunications Services," in Gerard Pogorel (ed.), *Global Telecommunications Strategies and Technological Changes*, pp. 227-239. Elsevier. Amsterdam: 1993.
7. *Proposal to the Bank of Greece on the Organization of Primary and Secondary Markets in Greek State Bills, Notes and Bonds* (1993).
8. "Liquidity and Markets," in *The New Palgrave Dictionary of Finance*, New York: 1992.
9. "Compatibility and the Creation of Shared Networks," in *Electronic Services Networks: A Business and Public Policy Challenge*, edited by Margaret Guerin-Calvert and Steven Wildman, Praeger Publishing Inc., New York: 1991.
10. *Oligopoly in Markets for Products Differentiated by their Characteristics*, Ph.D. dissertation, University of California, Berkeley, 1981.

C. WORKING PAPERS

1. "The Incentive of a Multiproduct Monopolist to Provide All Goods," Discussion Paper no. EC-95-09, Stern School of Business, N.Y.U.
2. "Monopolistic Competition with Two-Part Tariffs," Discussion Paper no. EC-95-10, Stern School of Business, N.Y.U. (with Steve Wildman).
3. "Critical Mass and Network Size with Application to the US Fax Market," Discussion Paper no. EC-95-11, Stern School of Business, N.Y.U. (with Charles Himmelberg).
4. "Technical Standards Coalitions for Network Goods," Discussion Paper no. EC-95-12, Stern School of Business, N.Y.U. (with Fredrick Flyer).
5. "Strategic Commitments and the Principle of Reciprocity in Interconnection Pricing," mimeo. (with Giuseppe Lopomo and Glenn Woroch).
6. "Principles of Interconnection: A Response to 'Regulation of Access to Vertically-Integrated Natural Monopolies,'" submitted to the New Zealand Ministry of Commerce.
7. "Quality Choice and Vertical Integration," Discussion Paper no. EC-94-22, Stern School of Business, N.Y.U.
8. "The Max-Min Principle of Product Differentiation," Discussion Paper no. EC-94-16, Stern School of Business, N.Y.U. (with Asim Ansari and Joel Steckel).
9. "Equilibrium Fee Schedules in a Monopolist Call Market," Discussion Paper no. EC-94-15, Stern School of Business, N.Y.U. (with Jeff Heisler).

10. "The Incentive for Vertical Integration," Discussion Paper EC-94-05, Stern School of Business, N.Y.U.
11. "Mixed Bundling in Duopoly," Discussion Paper EC-93-29, Stern School of Business, N.Y.U.
12. "One-Way Networks, Two-Way Networks, Compatibility, and Public Policy," Discussion Paper EC-93-14, Stern School of Business (with Lawrence J. White).
13. "Benefits and Pitfalls of Network Interconnection," Discussion Paper no. EC-92-31, Stern School of Business, N.Y.U. (with Glenn Woroch).
14. "Does it Pay to be First? Sequential Choice of Locations of Differentiated Products," Discussion Paper EC-91-24, Stern School of Business, N.Y.U. (with Jamie Howell).
15. "Compatibility and Market Structure," Discussion Paper EC-91-16, Stern School of Business, N.Y.U.
16. "Co-existence of Call and Continuous Markets," mimeo. (with Jeff Heisler).
17. "Market Structure of Broadband and Multimedia Services on the Information Superhighway," mimeo. (with David Salant).
18. "The Benefits of Franchising and Vertical Disintegration in Markets for Locationally Differentiated Products," mimeo.
19. "Variable Compatibility Without Network Externalities," Discussion Paper No. 157, Center for Economic Policy Research, Department of Economics, Stanford University.
20. "The Choice of Strategy Space in Duopoly," mimeo.
21. "A Simple Model of Trade in Differentiated Products," International Economics Research Center Discussion Paper No. 26 (1995), Department of Economics, Columbia University.
22. "One-sided and Two-sided Commitments," Discussion Paper No. 337, Department of Economics, Columbia University.
23. "Equilibrium Coalition Structures," Discussion Paper No. 273, Columbia University, Department of Economics.
24. "Stable Open Shop Unions," Discussion Paper No. 247, Columbia University, Department of Economics.

D. WORK IN PROGRESS

1. *Communications Convergence: Economic Perspectives on Quality and Market Evolution*, American Enterprise Institute & M.I.T. Press (1996) (with Robert Dansby).